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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/706,767	11/12/2003	Peter Micah Sandvik	134166	7781

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EXAMINER
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CYGAN, MICHAEL T

ART UNIT	PAPER NUMBER
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2855

DATE MAILED: 12/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/706,767	Applicant(s) SANDVIK ET AL.	
	Examiner Michael Cygan	Art Unit 2855	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 08 November 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1,2,5-26 and 29-51 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-26 and 29-51 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 November 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. Claims 1, 2, 5-26, and 29-51 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 1 has been amended to require a catalytic gate electrode deposited on a semiconductor surface such that the device is formed from layers of different dopings in a semiconductor device selected from a group of HFET, MISFET, MESFET, MISHFET, capacitor, resistor, and diode.

None of applicant's figures show such a device. Figures 1, 2, and 7-9 are not detailed, and are not described as any of the members of the group. Nor do they show layers of different dopings. Figure 3 shows a MISHFET; however, the catalytic gate electrode is not "on the surface" of the semiconductor; rather, the electrode is on the surface of a (silicon dioxide or silicon nitride) passivation layer. Figure 4 shows a HFET; however, each layer is undoped and thus does not present "layers of different dopings". The gate electrode is not formed from dopants; rather, it is formed from a metallic stack. Figure 5 shows a Schottky diode, which does not show layers of different dopants, and is argued against being a member of the group in applicant's last response. Figure 6 shows a

MOSFET, which is not among the listed members of the group; even so, the catalytic gate electrode rests on oxide layers rather than on the "surface" of the semiconductor. Since the specification discusses only generalities, or examples having structure incompatible with the requirements of an apparatus constructed according to the limitations of claim 1, the specification fails to teach how to make and use the claimed invention without undue experimentation on the part of one having ordinary skill in the gas sensor art.

Further evidence is shown by the incorporation of "capacitor" and "resistor" into the group of members in claim 1. A "gate electrode" is a term of art associated with transistors and diodes, not capacitors or resistors. While a device which includes gate electrodes, ohmic contacts, passivation layers, and layers of different dopings may possess a capacitance or a resistance, no guidance is provided in applicant's disclosure as to exactly how one would construct such parts into a whole device which functions as a capacitor or resistor. The specification, even when viewed with the knowledge of one of ordinary skill in the art, would not enable the construction of a capacitor or resistor having catalytic gate electrode, ohmic contacts, and passivation layer, in such a way to be formed from different dopings.

The specification, while presenting the individual components, does not enable the specific combination of limitations presented in claim 1 in such a way that one skilled in the art could make and/or use the invention without undue experimentation. Claims 25, 47, 48, and 51 each possess similarly non-enabled

combinations of limitations; these claims are rejected with claim 1 along with their respective dependent claims.

### ***Drawings***

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, each member of the group of devices in claim 1 must be shown having all of the claimed limitations or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not

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accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, 5, 6, 12-15, 17, 18, 20-22, 25, 26, 19, 30, 36-38, 40, 41, and 44 are rejected under 35 U.S.C. 102(b) as being anticipated by von Windheim (US 5,285,084). Windheim discloses the claimed invention, a gas sensing Schottky diode comprising a partially doped semiconductor (diamond, SiC, gallium nitride, or boron nitride) substrate [18,11], a catalytic gate electrode (Pt or Pd) [12], an ohmic contact [13] of a refractory metal such as titanium, a passivation layer [21] of silicon dioxide, and an encapsulation layer [17]; the sensor detects gases such as hydrogen at temperatures up to about 1400 degrees Celsius. See entire document, especially Figure 1 and columns 1-6. The semiconductor has layers of different dopings (Figure 1) and comprises a diode.

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4. Claims 1, 2, 5, 6, 13-15, 17, 20-22, 24, 48, and 49 are rejected under 35 U.S.C. 102(b) as being anticipated by Baranzahi (US 6,109,094). Baranzahi discloses the claimed invention, a gas sensing Schottky diode, FET, or MISFET comprising a partially doped semiconductor (SiC or diamond) substrate [1], a stack of catalytic layers including a catalytic gate electrode (Pt or Pd) [5], an ohmic contact of a metal such as platinum, a passivation layer [2] of silicon dioxide; the sensor is heated (inherently by a heater means which maintains the temperature at 650 degrees Celsius as shown in Figure 4) and detects gases such as hydrocarbon or oxygen at temperatures up to at least 800 degrees Celsius. See entire disclosure, especially Figures 2-4 and columns 2-6.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 7-10 and 31-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over von Windheim (US 5,285,084) in view of Sibbald (US 4,931,851). Windheim teaches the claimed invention except for the use of osmium, platinum/rhodium, vanadium oxide, or mixtures thereof as the catalytically active metal. Sibbald teaches the use of osmium,

platinum/rhodium, vanadium oxide, or mixtures thereof as the catalytically active metal; see column 3 lines 21-54 and column 4 lines 35-49. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use osmium, platinum/rhodium, vanadium oxide, or mixtures thereof as the catalytically active metal as taught by Sibbald in the invention taught by Windheim, since different metals are taught to have specificity for different analyte gases.

6. Claims 11 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over von Windheim (US 5,285,084) in view of Onaga (US 4,816,800).

Windheim teaches the claimed invention except for the use of lanthanum metal oxide as the catalytically active metal. Onaga teaches the use of  $\text{LaNiO}_3$  as a metal oxide semiconductor to replace a Pt-Rh gas sensor; see columns 1-2. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use lanthanum metal oxide as the catalytically active metal as taught by Onaga in the invention taught by Windheim, since Onaga teaches the advantage of corrosion prevention.

7. Claims 19, 42 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over von Windheim (US 5,285,084) in view of Najafi (US 6,140,144). Windheim teaches the claimed invention except for the use of a flip-chip design. Najafi teaches a flip-chip design for gas microsensors; see



abstract. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a flip-chip design as taught by Najafi in the invention taught by von Windheim to form the sensor, since Najafi teaches the advantages of controlling the sensor environment.

8. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over von Windheim (US 5,285,084) in view of Kang (US 5,656,827). Windheim teaches the claimed invention except for the use of multiple sensors sensing different gases. Kang teaches a FET sensor array having multiple gas selectivities; see column 11 lines 49-59. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use multiple sensors sensing different gases as taught by Kang in the invention taught by von Windheim to form the sensor, since this would allow more discriminate analysis of the sensing fluid.
9. Claims 16 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baranzahi (US 6,109,094) in view of Khan (US 6,690,042 B2). Baranzahi teaches the claimed invention except for the use of a heterostructure barrier layer to form a MISHFET. Khan teaches the use of a heterostructure AlGaIn layer in a MISFET; see Figure 3. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a heterostructure barrier layer to form a MISHFET as taught by

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Khan in the invention taught by Baranzahi, since Khan teaches the advantage of lower leakage currents as well as improved performance characteristics; see abstract.

10. Claims 25, 26, 29, 30, 41, 43, and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baranzahi (US 6,109,094) in view of von Windheim (US 5,285,084). Baranzahi teaches the claimed invention except for an encapsulation layer. Von Windheim teaches an encapsulation layer for a FET gas sensor; see [17] of Figure 1. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use an encapsulation layer as taught by von Windheim in the invention taught by Baranzahi to form the sensor, since von Windheim teaches the advantage of protection of the sensor elements.

11. Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baranzahi (US 6,109,094) in view of von Windheim (US 5,285,084) as applied to claim 25, further in view of Khan (US 6,690,042 B2). Baranzahi teaches the claimed invention except for the use of a heterostructure barrier layer to form a MISHFET. Khan teaches the use of a heterostructure AlGaIn layer in a MISFET; see Figure 3. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a heterostructure barrier layer to form a MISHFET as taught by Khan in the

invention taught by Baranzahi, since Khan teaches the advantage of lower leakage currents as well as improved performance characteristics; see abstract.

12. Claim 50 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baranzahi (US 6,109,094) in view of Shields (US 5,698,771). Windheim (US 5,285,084) as applied to claim 25, further in view of Khan (US 6,690,042 B2). Baranzahi teaches the claimed invention except for the use of an AIN insulating layer. Shields teaches the use of an AIN insulating layer in a MISFET sensor; see column 5 lines 9-28. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use an AIN insulating layer as taught by Shields in the invention taught by Baranzahi, since Shields teaches that AIN and silicon oxide films are equivalent for use as insulator layers.

### ***Response to Arguments***

13. Applicant's arguments with respect to claims rejected over von Windheim have been considered but are moot in view of the new ground(s) of rejection.
14. Applicant's arguments filed 08 November 2004 have been fully considered but they are not persuasive. With respect to rejections based upon Baranzahi as not teaching a gate electrode on the surface, Baranzahi teaches such a

configuration for two reasons. First, the electrode is on the surface, even though another layer intervenes; the claim does not require the layer to be adjacent. Second, such an interpretation is consistent with applicant's MISHFET as shown in applicant's Figure 3, in which the gate electrode is on the surface of the semiconductor even though a passivation layer (made of non-semiconductor material) intervenes.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Cygan whose telephone number is (571) 272-2175. The examiner can normally be reached on 8:30-6 M-Th, alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Lefkowitz can be reached on 571-272-2180. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
MICHAEL CYGAN, PH.D.  
PRIMARY EXAMINER